

# NATIONAL BUREAU OF STANDARDS REPORT

No.7039

on  
Interlaboratory Intercomparisons  
of  
96-Inch High-Output Fluorescent Lamps

by  
Velma I. Burns  
Photometry and Colorimetry Section  
Metrology Division



U. S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS

## THE NATIONAL BUREAU OF STANDARDS

### Functions and Activities

The functions of the National Bureau of Standards are set forth in the Act of Congress, March 3, 1901, as amended by Congress in Public Law 619, 1950. These include the development and maintenance of the national standards of measurement and the provision of means and methods for making measurements consistent with these standards; the determination of physical constants and properties of materials; the development of methods and instruments for testing materials, devices, and structures; advisory services to government agencies on scientific and technical problems; invention and development of devices to serve special needs of the Government; and the development of standard practices, codes, and specifications. The work includes basic and applied research, development, engineering, instrumentation, testing, evaluation, calibration services, and various consultation and information services. Research projects are also performed for other government agencies when the work relates to and supplements the basic program of the Bureau or when the Bureau's unique competence is required. The scope of activities is suggested by the listing of divisions and sections on the inside of the back cover.

### Publications

The results of the Bureau's work take the form of either actual equipment and devices or published papers. These papers appear either in the Bureau's own series of publications or in the journals of professional and scientific societies. The Bureau itself publishes three periodicals available from the Government Printing Office: The Journal of Research, published in four separate sections, presents complete scientific and technical papers; the Technical News Bulletin presents summary and preliminary reports on work in progress; and Basic Radio Propagation Predictions provides data for determining the best frequencies to use for radio communications throughout the world. There are also five series of nonperiodical publications: Monographs, Applied Mathematics Series, Handbooks, Miscellaneous Publications, and Technical Notes.

Information on the Bureau's publications can be found in NBS Circular 460, Publications of the National Bureau of Standards (\$1.25) and its Supplement (\$1.50), available from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

# NATIONAL BUREAU OF STANDARDS REPORT

NBS PROJECT

NBS REPORT

0201-20-02113

December 1960

7039

Interlaboratory Intercomparisons  
of  
96-Inch High-Output Fluorescent Lamps

by  
Velma I. Burns  
Photometry and Colorimetry Section  
Metrology Division

## IMPORTANT NOTICE

NATIONAL BUREAU OF STANDARDS  
Intended for use within the Government,  
this report is not to be distributed  
to additional evaluation and re-  
listing of this Report, either in  
the Office of the Director, National  
Bureau of Standards, or by the Government,  
however, by the Government,  
to reproduce additional copies.

Approved for public release by the  
director of the National Institute of  
Standards and Technology (NIST)  
on October 9, 2015

Progress accounting documents  
nally published it is subjected  
eproduction, or open-literature  
on is obtained in writing from  
such permission is not needed,  
prepared if that agency wishes



U. S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS



Interlaboratory Intercomparisons  
of  
96-Inch High-Output Fluorescent Lamps

Abstract

Three groups of six high-output fluorescent lamps were measured by each of three laboratories. Each laboratory supplied and seasoned one group of lamps of their own manufacture for use in this intercomparison.

I. Measurements

This Intercomparison was undertaken to determine uniformity of measurements on high-output fluorescent lamps made at the three participating laboratories. Each laboratory supplied and seasoned a group of six high-output fluorescent lamps manufactured by its company. Each laboratory followed its own procedure, that normally used in obtaining data for public use. The lamps were operated in series with a reference ballast having an impedance of 215 ohms and a power factor of 7.5 per cent. The ambient temperature was held at 77°F. Measurements were made of lumens, lamp volts, lamp amperes and lamp watts. After being measured in the laboratory of origin each group of lamps was sent to the other two laboratories for measurement.

2. Results

The results are reported in the following tables. The order in which the laboratory results are reported is the same as the order in which the results were obtained; the laboratory listed first is the laboratory of origin in each case.



Table I.

F96PG17/CW Lamps

Lamp current set at 1.50 Amperes

Cathodes unheated

Table 1a-Lumens

Lamp No.	G.E.	Syl.	West.	Ave.
MPG-1	13362	14065	13105	13510.7
3	13280	14165	12705	13383.3
4	13240	14150	12645	13345.0
5	13138	13580	12285	13001.0
6	13219	13720	12665	13201.3
7	13433	14010	12637	13360.0
Ave.	13278.7	13948.3	12673.7	13300.2
$\Delta$	- 21.5	+ 648.1	- 626.5	
% $\Delta$	- .2%	+ 4.9%	- 4.7%	

Table 1b - Lamp Volts

Lamp No.	G.E.	Syl	West.	Ave.
MPG-1	176.7	173.5	172	174.07
3	170.0	167.0	160	165.67
4	179.0	175.0	166	173.33
5	172.6	163.0	157	164.20
6	178.5	169.0	169	172.17
7	175.4	168.0	162	168.47
Ave.	175.37	169.25	164.33	169.65
$\Delta$	+ 5.72	- .40	- 5.32	
% $\Delta$	+ 3.4%	- .2%	- 3.1%	

Table 1c - Lamp Watts

Lamp No.	G.E.	Syl.	West.	Ave.
MPG- 1	219.0	218.0	212	216.33
3	210.0	210.0	200	206.67
4	217.2	218.0	206	213.73
5	211.0	207.0	198	205.33
6	219.0	214.5	205	212.83
7	214.0	210.5	204	209.50
Ave.	215.03	213.00	204.17	210.73
$\Delta$	+ 4.30	+ 2.27	- 6.56	
% $\Delta$	+ 2.0%	+ 1.1%	- 3.1%	







Table 1d - Lumens per Watt

Lamp No.	G.E.	Syl.	West.	Ave.
MPG-1	61.0	64.5	61.82	62.44
3	63.2	67.4	63.53	64.71
4	61.0	64.9	61.38	62.43
5	62.3	65.6	62.05	63.32
6	60.4	64.0	61.78	62.06
7	62.8	66.5	61.94	63.75
Ave.	61.78	65.48	62.08	63.11
$\Delta$	- 1.33	+ 2.37	- 1.03	
% $\Delta$	- 2.1%	+ 3.8%	- 1.6%	

Table 2. F96T12/CW/SHO Lamps

400 line volts set

Cathodes continuously heated

Table 2a - Lumens

Lamp No.	West.	Syl.	G.E.	Ave.
1	14605	14315		14460.0
2	14262	14210	12947	13806.3
3	14572	14110	12901	13861.0
4	14335	14250	13075	13886.7
5	14131	14380	12599	13703.3
6	14150	14050	13464	13888.0
Ave. of 6	14342.5	14219.2		
Ave. of 5	14290.0	14200.0	12997.2	13829.1
$\Delta$	+ 460.9	+ 370.9	- 831.9	
% $\Delta$	+ 3.3%	+ 2.7%	- 6.0%	

Table 2b-Lamp Volts

Lamp No.	West.	Syl.	G.E.	Ave.
1	174	165		169.5
2	166	161	168.0	165.0
3	171	161	165.2	165.7
4	172	162	165.4	166.5
5	169	169	165.2	167.7
6	164	161	168.6	164.5
Ave. of 6	169.3	163.2		
Ave. of 5	168.4	162.8	166.5	165.9
$\Delta$	+ 2.5	- 3.1	+ .6	
% $\Delta$	+ 1.5%	- 1.9%	+ .4%	



Table 2c-Amperes

Lamp No.	West.	Syl.	G.E.	Ave.
1	1.49	1.53		1.510
2	1.51	1.54	1.48	1.510
3	1.50	1.52	1.52	1.513
4	1.49	1.54	1.54	1.523
5	1.50	1.51	1.49	1.500
6	1.51	1.54	1.55	1.533
Ave. of 6	1.500	1.530		
Ave. of 5	1.502	1.530	1.516	1.516
$\Delta$	- .014	+ .014	.000	
% $\Delta$	- .92%	+ .92%	.00%	

Table 2d-Arc Watts

Lamp No.	West.	Syl.	G.E.	Ave.
1	212	211.0		211.5
2	207	210.5	205.6	207.7
3	210	207.0	208.6	208.5
4	210	210.0	209.2	209.7
5	208	213.0	205.2	208.7
6	205	209.0	210.8	208.3
Ave. of 6	208.7	210.1		
Ave. of 5	208.0	209.9	207.9	208.6
$\Delta$	- .6	+ 1.3	- .7	
% $\Delta$	- .29%	+ .62%	- .34%	

Table 2e - Lumens per Arc Watt

Lamp No.	West.	Syl.	G.E.	Ave.
1	68.9	67.8		68.35
2	68.9	67.5	63.0	66.47
3	69.4	68.2	61.8	66.47
4	68.3	67.8	62.5	66.20
5	67.9	67.5	61.4	65.60
6	69.0	67.2	63.9	66.70
Ave. of 6	68.73	67.67		
Ave. of 5	68.70	67.64	62.52	66.29
$\Delta$	+ 2.41	+ 1.35	- 3.77	
% $\Delta$	+ 3.6%	+ 2.0%	- 5.7%	



Table 3. F96T12/CW/VHO Lamps  
400 line volts set  
Cathodes continuously heated  
Table 3a-Lumens

Lamp No.	Syl.	West.	G.E.	Ave.
1	13980	13258	13087	13441.7
2	14120	13478	13087	13561.7
3	14230	12822	12893	13315.0
4	14360	12920	12821	13367.0
5	14200	13740	12964	13634.7
6	14200	12990	12964	13384.7
Ave.	14181.7	13201.3	12969.3	13450.8
$\Delta$	+ 730.9	- 249.5	- 481.5	
% $\Delta$	+ 5.4%	- 1.9%	- 3.6%	

Table 3b-Amperes

Lamp No.	Syl.	West.	G.E.	Ave.
1	1.54	1.53	1.50	1.523
2	1.54	1.52	1.51	1.523
3	1.55	1.55	1.60	1.567
4	1.54	1.54	1.54	1.540
5	1.55	1.55	1.56	1.553
6	1.55	1.54	1.59	1.560
Ave.	1.545	1.538	1.550	1.544
$\Delta$	+ .001	- .006	+ .006	
% $\Delta$	+ .06%	- .39%	+ .39%	

Table 3c - Lamp Volts

Lamp No.	Syl.	West.	G.E.	Ave.
1	165	167	170.8	167.6
2	164	166	167.6	165.9
3	163	160	166.8	163.3
4	164	162	166.4	164.1
5	163	157	167.0	162.3
6	162	160	165.4	162.5
Ave.	163.5	162.0	167.3	164.3
$\Delta$	- .8	- 2.3	+ 3.0	
% $\Delta$	- .5%	- 1.4%	+ 1.8%	



Table 3d-Arc Watts

Lamp No.	Syl.	West.	G.E.	Ave.
1	212.5	215	213.6	213.70
2	212.5	213	209.6	211.70
3	213.0	210	214.2	212.40
4	213.5	209	210.4	210.97
5	214.5	207	212.2	211.23
6	211.5	210	210.6	210.70
Ave.	212.92	210.67	211.77	211.79
$\Delta$	+ 1.13	- 1.12	- .02	
% $\Delta$	+ .53%	- .53%	- .01%	

Table 3e-Lumens per Arc Watt

Lamp No.	Syl.	West.	G.E.	Ave.
1	65.8	61.67	61.3	62.92
2	66.4	63.28	62.4	64.03
3	66.8	61.06	60.2	62.69
4	67.2	61.82	60.9	63.31
5	66.2	66.38	61.1	64.56
6	67.1	61.86	61.7	63.55
Ave.	66.58	62.68	61.27	63.51
$\Delta$	+ 3.07	- .83	- 2.24	
% $\Delta$	+ 4.8%	- 1.3%	- 3.5%	







## THE NATIONAL BUREAU OF STANDARDS

The scope of activities of the National Bureau of Standards at its major laboratories in Washington, D.C., and Boulder, Colo., is suggested in the following listing of the divisions and sections engaged in technical work. In general, each section carries out specialized research, development, and engineering in the field indicated by its title. A brief description of the activities, and of the resultant publications, appears on the inside of the front cover.

### WASHINGTON, D.C.

**ELECTRICITY.** Resistance and Reactance. Electrochemistry. Electrical Instruments. Magnetic Measurements. Dielectrics.

**METROLOGY.** Photometry and Colorimetry. Refractometry. Photographic Research. Length. Engineering Metrology. Mass and Scale. Volumetry and Densimetry.

**HEAT.** Temperature Physics. Heat Measurements. Cryogenic Physics. Rheology. Molecular Kinetics. Free Radicals Research. Equation of State. Statistical Physics. Molecular Spectroscopy.

**RADIATION PHYSICS.** X-Ray. Radioactivity. Radiation Theory. High Energy Radiation. Radiological Equipment. Nucleonic Instrumentation. Neutron Physics.

**CHEMISTRY.** Surface Chemistry. Organic Chemistry. Analytical Chemistry. Inorganic Chemistry. Electrodeposition. Molecular Structure and Properties of Gases. Physical Chemistry. Thermochemistry. Spectrochemistry. Pure Substances.

**MECHANICS.** Sound. Pressure and Vacuum. Fluid Mechanics. Engineering Mechanics. Combustion Controls.

**ORGANIC AND FIBROUS MATERIALS.** Rubber. Textiles. Paper. Leather. Testing and Specifications. Polymer Structure. Plastics. Dental Research.

**METALLURGY.** Thermal Metallurgy. Chemical Metallurgy. Mechanical Metallurgy. Corrosion. Metal Physics.

**MINERAL PRODUCTS.** Engineering Ceramics. Glass. Refractories. Enameled Metals. Constitution and Microstructure.

**BUILDING RESEARCH.** Structural Engineering. Fire Research. Mechanical Systems. Organic Building Materials. Codes and Safety Standards. Heat Transfer. Inorganic Building Materials.

**APPLIED MATHEMATICS.** Numerical Analysis. Computation. Statistical Engineering. Mathematical Physics.

**DATA PROCESSING SYSTEMS.** Components and Techniques. Digital Circuitry. Digital Systems. Analog Systems. Applications Engineering.

**ATOMIC PHYSICS.** Spectroscopy. Radiometry. Mass Spectrometry. Solid State Physics. Electron Physics. Atomic Physics.

**INSTRUMENTATION.** Engineering Electronics. Electron Devices. Electronic Instrumentation. Mechanical Instruments. Basic Instrumentation.

Office of Weights and Measures.

### BOULDER, COLO.

**CRYOGENIC ENGINEERING.** Cryogenic Equipment. Cryogenic Processes. Properties of Materials. Gas Liquefaction.

**IONOSPHERE RESEARCH AND PROPAGATION.** Low Frequency and Very Low Frequency Research. Ionospheric Research. Prediction Services. Sun-Earth Relationships. Field Engineering. Radio Warning Services.

**RADIO PROPAGATION ENGINEERING.** Data Reduction Instrumentation. Radio Noise. Tropospheric Measurements. Tropospheric Analysis. Propagation-Terrain Effects. Radio-Meteorology. Lower Atmosphere Physics.

**RADIO STANDARDS.** High frequency Electrical Standards. Radio Broadcast Service. Radio and Microwave Materials. Atomic Frequency and Time Standards. Electronic Calibration Center. Millimeter-Wave Research. Microwave Circuit Standards.

**RADIO SYSTEMS.** High Frequency and Very High Frequency Research. Modulation Research. Antenna Research. Navigation Systems. Space Telecommunications.

**UPPER ATMOSPHERE AND SPACE PHYSICS.** Upper Atmosphere and Plasma Physics. Ionosphere and Exosphere Scatter. Airglow and Aurora. Ionospheric Radio Astronomy.

